Snakebite and Acute Kidney Injury: We Must do Better!

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Snakebite is one of the most neglected public health issues in rural areas causing significant death and disability. Actual burden of snakebite remains elusive due to serious under-reporting. Majority of victims die even before reaching hospital [1,2]. South Asia is the most heavily affected region of the globe. The highest figures reported from Asia, so far, come from a community-based survey conducted in South-East Nepal in 2002 [1]. In India alone, about 45,900 people are estimated to die from snake bites according to Million Death Study [2].

The Indian subcontinent is well known for its snake biodiversity. However, species of the family of Elapidae and Viperidae are responsible for most deaths and disabilities related to snakebite. Among the true vipers, Russell's viper (*Daboiarusselii*) is associated with the highest morbidity and mortality. In Anuradhapura District, Sri Lanka, up to 73% of all admitted snakebites were attributed to this species [3], whose distribution extends from the Indus valley of Pakistan in West and Kashmir, India in the North to the foothills of the Himalayas in Nepal and Bhutan, and to Bangladesh in the East.

Snake inflicted morbidity and death occurs through cytotoxic, hematotoxic, or neurotoxic mechanisms. Apart from local swelling and tissue damage, viperidae venom can also induce coagulopathy and platelet dysfunction leading to systemic bleeding and hemorrhage from the local site. Intracranial hemorrhage, including pituitary hemorrhage, and multiorgan dysfunction may occur. In addition, envenoming by Russell's viper can cause generalized rhabdomyolysis induced by Phospho-lipaseA2, which may cause myoglobinemia, hyperkalemia, and acute kidney injury (AKI) [4]. AKI may also result from the direct action of some venoms and associated hypotension due to bleeding. Venomous snakebite accounts for a notable proportion of victims with AKI in regions with viper envenoming including in India, as was also witnessed in the study by Krishnamurthy, *et al.* [5] in this issue of *Indian Pediatrics.*

Factors that determine the outcome of snakebite management are multifactorial [6]. Delay in seeking health care due to misbelief, difficult terrain, inadequate knowledge and skill of medical fraternity, and lack of provision of appropriate antivenom and appropriate supportive management of complications, are few examples. A survey conducted in India and Pakistan showed that many doctors were unable to recognize systemic signs of envenoming [7]. Similarly, most of the time snakebite victims do not receive appropriate dose of antivenom and/or assisted ventilation when needed [8]. Since AKI is seen to occur in a majority of snakebite victims, lack of renal replacement therapy in rural/remote areas where most snakebites occur, and late referral to the center with facilities for dialysis and mechanical ventilation are some of the major determinants of fatalities, which need to be addressed. This preventable and reversible cause of AKI is more relevant in the context of The International Society of Nephrology initiative, called "0 by 25" program, which aims to eliminate preventable death from AKI in the poorest parts of Africa, Asia and Latin America by 2025 [9].

Education of the communities as well as caregivers on how to avoid and protect from snakebites by wearing protective boots in paddy fields or while performing outdoor activities, not sleeping on ground, using mosquito nets, seeking early medical help, and avoiding arterial tourniquet can help reduce consequences of snakebite and envenoming [10]. This is especially relevant in pediatric snakebites as the venom can affect children more quickly due to their low body mass. This may help mitigate the death and disabilities related to snakebite envenoming.

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REFERENCES

1. Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala S. Impact of snake bites and determinants of fatal outcomes in southeastern Nepal. Am J Trop Med Hyg. 2004;71:234-8.
2. Mohapatra B, Warrell DA, Suraweera W, Bhatia P, Dhingra N, Jotkar RM, *et al.* Snakebite mortality in India: A nationally representative mortality survey. PLoS Negl Trop Dis. 2011;5:e1018.
3. Phillips RE, Theakston RD, Warrell DA, Galigedara Y, Abeysekera DT, Dissanayaka P, *et al.* Paralysis, rhabdomyolysis and haemolysis caused by bites of Russell's viper (Viperarussellipulchella) in Sri Lanka: failure of Indian (Haffkine) antivenom. Q J Med. 1988; 68:691-715.
4. Gutiérrez JM, Theakston RDG, Warrell DA. Confronting

the neglected problem of snake bite envenoming: The need for a global partnership. PLoS Med. 2006;3:e150.
5. Krishnamurthy S, Gunasekaran K, Mahadevan S, Bobby Z, Kumar AP. Russell's viper envenomation-associated acute kidney injury in children in Southern India. Indian Pediatr. 2015;52:583-6.
6. Ismail AK. The path to improving the clinical management on snakebite and envenomation management: An unexpected yet necessary journey. Research Updates in Medical Sciences. 2014;2:33-6.
7. Simpson ID. A study of the current knowledge base in treating snake bite amongst doctors in the high-risk countries of India and Pakistan: does snake bite treatment training reflect local requirements? Trans R Soc Trop Med Hyg. 2008;102:1108-14.
8. Chauhan S. Pre-hospital treatment of snake envenomation in patients presented at a tertiary care hospital in northwestern India. J Venom Anim Toxins Incl Trop Dis. 2005;11:275-82.
9. Schieppati A, Perico N, Remuzzi G. Eliminating treatable deaths due to acute kidney injury in resource-poor settings. Semin Dial. 2015;28:193-7.
10. Sharma SK, Bovier P, Jha N, Alirol E, Loutan L, Chappuis F. Effectiveness of rapid transport of victims and community health education on snake bite fatalities in rural Nepal. Am J Trop Med Hyg. 2013;89:145-50.

Snake Bite: A Neglected Tropical Condition

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Since reporting is not mandatory in many regions of the world, snakebites often go unreported [1]. Consequently, no large-scale study has ever been conducted to determine the incidence of snakebites. However, some estimates put the number at 5.4 million snakebites, 2.5 million envenomings, resulting in perhaps 125,000 deaths [1]. According to the most conservative estimates, at least 81,000 snake envenomings and 11,000 fatalities occur in India each year, making it the most heavily affected country in the world [1]. It is most unfortunate that despite a large population getting bitten by snakes every year and a large number succumbing to its complications, not much has been done to handle this preventable envenomation. Ignorance about the problem and the prevalent cultural practices delay arrival of patients to equipped health centers. Moreover, the anti-snake venoms (ASV) available in market are not effective against venoms of all snakes responsible for envenomation, adding to the mortality. More research in this area is needed to make suitable and safe ASVs to take care of regional variations in distribution of snakes. Community education to population at-risk regarding the behavior of snakes inhabiting their region, features of snake envenomation, do's and don'ts after a snake bite, and more specifically the transportation of a victim to a health centre will change the scenario favorably.

Of the roughly 3,000 known species of snake found worldwide, only 15% are considered dangerous to humans [1,2]. There are two major families of venomous snakes, *Elapidae* and *Viperidae*. Three hundred and twenty five species in 61 genera are recognized in the family *Elapidae* [3], and 224 species in 32 genera are recognized in the family *Viperidae* [4]. In addition, the most diverse and widely distributed snake family, the *Colubridae*, has approximately 700 venomous species [5] but only five genera – boomslangs, twig snakes, keelback snakes, green snakes, and slender snakes – have caused human fatalities [5]. In the Indian subcontinent, almost all snakebite deaths have traditionally been attributed to the big four – Russell's viper, Indian cobra, saw-scaled viper and the common krait [6]. However, studies have shown that the hump-nosed viper, previously considered essentially harmless and misidentified as the saw-scaled viper, is capable of delivering a fatal bite [7]. In regions of Kerala, India, it may be responsible for nearly 10% of venomous bites [7]. Commonly used anti-venoms in India do not appear to be effective against hump-nosed viper bites [7]. The Malayan pit viper and banded krait are two other species involved in a significant number of venomous bites.

The Madras Crocodile Bank Trust and Centre for Herpetology (MCBT), in collaboration with scientists at the Indian Institute of Science (IIS) and National Center for Biological Sciences (NCBS) and the Global Snakebite Initiative have begun a project that will initially concentrate on Russell's viper which is responsible for many serious and fatal bites. Venom will be collected from ten different geographic areas around India, quickly frozen using a new Geological Survey of